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EXPLOITING TECHNOLOGY

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The United States purportedly enjoys a lead over the Soviet Union with regard to the technology of modern conventional weaponry. But this lead in technology is of no avail if we do not exploit it. Pursuing technology is a science. Exploiting this technology to provide the end product--operational capability--is evidently an elusive art form.

We do quite well in exploiting emerged technology in fabricating our basic platforms--whether they be fighters, bombers, transports, or tanks. In fact, at times we go too far and too fast in that direction. However, it is quite another culture when it comes to exploiting technology to provide air-delivery platforms with new and improved engagement systems and armament to engage and destroy enemy ground targets.

The opportunity exists to make great strides in this area. If we continue the practices of the past, however, our efforts will be characterized by lost opportunities, needless starts and stops, and an overall pace generally attributed to the advance of glaciers.

What is the basis for this gloomy projection? The poor track record stems primarily from a continued focus on pursuing technology as distinct from attaining operational capability. We continue to conduct technology projects that lead only to other technology projects, when we should be undertaking development programs that lead to operational capability.

Let me explain the critical differences between these two efforts in the context of weaponry for aircraft delivery systems: Technology projects have the goal of studying "navigation," "sensors," "tracking," "classification," or some other function, technique, or phenomenology.

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Development programs, in contrast, focus on providing weaponry for the operational inventory--i.e., equipping some existing force element with some type of weapon to accomplish stated operational acts according to a well-defined operational concept.

Efforts on technology are to be applauded. They provide the basis for proceeding with development programs. There are times when stand-alone technology projects are appropriate--e.g., to demonstrate some proof of principle.

Where we go wrong is failing to wean ourselves from a technical orientation to an operational focus. Rather than biting the bullet and undertaking a development program, we undertake hybrid programs. A hybrid program sounds like it could be a program to provide some operational capability but, in the final analysis, it does not. Like the hybrid mule, these efforts produce no offspring.

These hybrid programs are easy to spot. They are named by ugly acronyms relating to technical things like navigation, propulsion, aerodynamics, guidance, sensors. Many times the acronym ends in "S." This stands for system and is designed to lull the unwary into the belief that the effort does indeed have an operational focus.

However, these efforts do not lead to operational capability for a simple but deterministic reason. The statement of work is not about equipping a force element to achieve an operational capability; it is about technology and phenomenology.

A project with such a structure does not allow a straightforward transition to full-scale development. Among other things, a source selection by an official in the technical community on a statement of work having a technical orientation cannot possibly be sustained when it comes to awarding a contract for full-scale development and the production of thousands of items.

DARPA is a primary source of our technology. We need to foster a process of exploiting this technology in a more timely fashion. Programs can be structured to do exactly this, and at times this has been done and done correctly.

In the mid-1970s, DARPA conducted an energetic program seeking new techniques for processing the data from powerful radars. The DARPA official in charge of this program advanced the proposition that one could detect moving vehicles at ranges up to 100 miles; moreover, the field of regard would be large enough to make this an effective surveillance and control system to effectively attack second-echelon divisions as they moved from assembly areas to departure areas and to the line of contact. The DARPA official formulated an operational concept for attacking these second-echelon divisions. This concept was given the name Assault Breaker.

The new and powerful Assault Breaker surveillance and control system could be used to provide "awareness" to commanders. It could also be used as an engagement or control system to facilitate destroying enemy combat elements by F-16s and by ground-launched missiles. In this concept, the engagement system was to identify when specified killing zones would be occupied. Also, the engagement system could guide (control) a missile all the way to the target. The concept was that this engagement system, coupled with weapons with smart munitions, would be quite effective in destroying enemy vehicles as they made their way to the front.

DARPA and the Air Force established a program to pursue this new engagement system. In keeping with the operational orientation, the system was not named after some technical aspect--like ADSARS, an advanced synthetic aperture radar system. Rather, the system was described generically as a surveillance and control system--the operational task to be accomplished--and was given a legitimate name--PAVE MOVER.

The program was structured in a unique and correct way. The statement of work in the RFP made it clear that the purpose of the program was to provide a system for the operational inventory to perform the operational tasks of surveillance and engagement. Two contractors were to be selected for a demonstration/validation phase. If one or both contractors could validate the concept, then the Government would negotiate a contract with one of the contractors for full-scale development and production.

To allow the transition to full-scale development, the commander of the Air Force Electronics Systems Division at Hanscom Air Force Base was to be the Source Selection Authority. The reasoning was straightforward. Source selection decisions made solely by DARPA officials on a DARPA technology project would not be binding and could not withstand protest in a subsequent full-scale development program by the Air Force.

By providing a smooth transition from a DARPA effort to an Air Force program, we almost accomplished something quite unique: We almost exploited technology in a timely fashion. However, the timeliness was eroded by the decision to make the program a joint program. The subsequent program was called Joint Surveillance and Targeting Attack Radar Systems (JSTARS). The decision to start over cost at least two years. Incidentally, the two contractors selected for the PAVE MOVER program also won the subsequent competition for JSTARS.

A similar situation exists today. There is a consensus that we should strive to achieve the operational capability to destroy Soviet Airborne Warning and Control System (AWACS) planes quickly and from long standoff. But, as yet, we are not on the road to purposeful action.

The titles of the efforts that might have an association with the capability to shoot down Soviet AWACS are a dead giveaway that timely and purposeful actions are lacking. An effort involving a vehicle called Swerve reflects a technical orientation. To change this effort to one about an integrated guidance system accomplishes nothing. Meaningful progress toward a capability to destroy Soviet AWACS at long range will not start until we undertake a development program that (1) starts with a statement of work that states quite clearly that the specific and avowed purpose of the program is to provide the capability of destroying Soviet AWACS quickly and from long range and (2) reflects a well-defined and agreed-to operational concept that defines tactics and equipment.

At this point, some of you in the audience are beginning to become restive about an item called "concurrency." Aren't we apt to undertake full-scale development before we are really ready to do so? I would argue that we are not.

If we undertake a development program in which the first phase is demonstration and validation, we can be somewhat aggressive in seizing opportunities to provide operational capabilities. If, at the end of the demonstration phase, we have demonstrated and validated the critical techniques, then we can in good conscience embark smoothly and without interruption upon full-scale development. If the critical techniques have not been demonstrated, then we should do one of two things: either extend the validation phase or have the courage and wisdom to cancel the program. A few false starts should be par for the course.

Now a few remarks about where I think we should focus our efforts in the realm of modern conventional weapons.

We now have real live development programs that, if sustained, will provide an imposing array of munitions. (In this vernacular, munitions--or submunitions--are the things that are dispensed over the targets by dispensers, weapons, or missiles.)

This array of munitions/warheads includes the following:

- Unitary warheads to destroy bridges and bunkers and to close tunnels; examples include the I-2000, the I-1000, and the Bunker Target Munition.
- The Combined Effect Bomblet (CEB), already in our inventory, to destroy soft targets, such as trucks, personnel, some lightly armored fighting vehicles, and soft facilities on airfields.
- Terminally guided munitions that can home on warm engines and destroy moving vehicles like tanks, armored personnel carriers, transporters, and trucks; these now include, in some stage of development, SKEET, Sense and Destroy Armor (SADARM), and Infra-Red Terminally Guided Submissile (IRTGSM).
- A munition to crater runways; the Boosted Kinetic Energy Penetrator (BKEP), now under development, is an example.

Unfortunately, we do not presently have, and we need, a development program to provide munitions to effectively mine railroads and roads.

But munitions cannot do their thing without an efficient means of deploying them at or over the target. Efficient dispensing of munitions and placing of warheads represents another opportunity for considerable improvement. We should seize the opportunity to have the capability of:

- Placing a unitary warhead at the precise point on a particular bridge, as determined by a bridge engineer who studied that bridge.
- Dispensing bomblets or terminally guided munitions in a somewhat ordered fashion over arrays of moving vehicles in various march formations.
- Dispensing cratering munitions accurately over runways or efficiently over shelters that house enemy aircraft.
- Dispensing mines where we want to along railroads and roads.

We can make standoff cruise missiles into smart weapons. These missiles will have their own on-board sensors, such as IR, RF, millimeter wave or CO_2 LADARS. The output from these sensors feeds an engagement system. The engagement system comes in two forms: human and computer.

In the human form, the nerve center is a weapon system operator (WSO). He is at the point of contact because he is connected to the sensors on the missile with a data-link. In this form, the WSO controls the engagement and thus makes the weapon a smart weapon in the context I described above. In this form, we have the world's most versatile engagement system in the act--the human brain. We also have the means of real-time bomb-damage assessment.

However, there will be circumstances when the attack aircraft will not penetrate to the vicinity of the target, and the aircraft will not be in range of the data-link when the missile is at the target. In these circumstances, we must use the second form of the engagement system to make the weapon (the dispenser) a smart weapon. In this case the data from the sensor must go to an engagement system on-board the missile itself. This form of an engagement system (the computer) must

be instructed ahead of time as to the trajectory the missile is to fly in the target scene. These instructions are based on prior pictures of this scene. Some technical people talk of target recognition. This totally misses the point. We know that that thing over the river is a bridge, that the long piece of concrete is a runway, or whatever. The job is not to recognize what we already know. Rather, the task is to guide the missile to the preselected point in the scene--a scene we have already studied quite carefully.

The GBU-15, the AGM-130, and the Israeli Pop Eye are examples of the data-link version of smart weapons/dispensers. The TLAM-C represents the type of weapon with an autonomous on-board engagement system.

We now have the prospect of equipping existing bombers to be retired from the SIOP with modern conventional weaponry. Specifically, there is the prospect of equipping B-52Gs with long-range standoff cruise missiles to accomplish stated operational acts according to well-defined operational concepts.[2] These long-range cruise missiles could be equipped with new on-board engagement systems and warheads/munitions to provide the capability to accomplish the following operational acts: drop railroad and highway bridges; mine railroads and roads; destroy enemy units in march formation or at choke points; destroy soft facilities on airfields; crater runways; destroy a variety of installations with precision; and mine harbors.

To my knowledge, every senior official who has considered this matter declares that equipping long-range combat aircraft (B-52Gs in particular) with conventionally armed long-range standoff cruise missiles is a good idea whose time has come. However, there is the ever-present problem of getting such a program under way and providing the required financing.

There are encouraging signs that we will indeed undertake and sustain a development program for the avowed purpose of equipping B-52s with cruise missiles to accomplish the stated operational acts.

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[2]See Stephen T. Hosmer and Glenn A. Kent, *The Military and Political Potential of Conventionally Armed Heavy Bombers,* The RAND Corporation, R-3508-AF, August 1987.

However, we must be clear that such an undertaking is quite distinct from continuing to study technical matters like cruise missile advanced guidance (CMAG), terminal laser radar (TLR), and zero circular error probability (Zero-CEP).

At this point, I hope I have made the case that the prime reason we are not making real progress toward timely operational capabilities is because we do not recognize and seize the opportunities now presented. Rather, we seem content to muddle along with dead-end technology projects.

There is also another reason for the lack of timely progress. This has to do with how we advocate programs for conventional weaponry.

Programs to provide weapons and munitions are generally advocated somewhat independently of a broader operational context; these programs in effect are left to stand by themselves. The necessary connective tissue between the programs and the requirements of the combatant commanders for particular operational capabilities is lacking.

In my view, the advocacy of these weapons should start two levels higher, and along the following lines: The regional strategy of the combatant commander for a particular region requires that force elements (like F-16 squadrons) be able to accomplish certain operational acts, for example, dropping bridges, mining roads, and destroying combat units in march formation on roads. The Chairman, Joint Chiefs of Staff, has recommended to the Secretary of Defense that the Air Force be tasked to provide this capability. (This is in accordance with the responsibilities set forth in the Reorganization Act of 1986.)

There is a well-defined operational concept for accomplishing these operational acts. This concept defines the tactics, the engagement systems, the weapons, and the munitions required. *The operational concept establishes how the operational acts or tasks are to be accomplished. The synergistic sum of the capability to accomplish tasks provides the capability required by the combatant commander to conduct his campaigns. Our advocacy can now establish the connective tissue from "strategy to task, and down to tactics and equipment."*[3]

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[3]See Glenn A. Kent, *Concepts of Operations: A More Coherent Framework for Defense Planning,* The RAND Corporation, N-2026-AF, August 1983.

I want to leave seven points:

- Technology cannot enhance the security of the United States unless it is exploited. The point is obvious. However, it seems in this case that restating the obvious is appropriate.
- With respect to conventional weapons, we are not exploiting emerged technology in time constants that could remotely be characterized as timely.
- Progress toward operational capability does not stem from projects that study phenomenology. Progress stems from programs with an operational focus. In the case of weapons this means we are specific--we are equipping some platform with some weapon to kill something according to a well-defined operational concept.
- Development programs are clearly diferent from dead-end technology projects. Development programs are structured to provide a straightforward and uninterrupted transition--after a successful demonstration/validation phase--to full-scale development and production. Dead-end technology programs do not. We should foster the former and avoid the latter.
- It is currently too easy to set up dead-end technology projects and too hard to sustain meaningful development programs. Somehow or another we must reverse these circumstances.
- We should advocate weapons in a larger context. We should pursue weapons in the context of an overall building--the operational capability we seek is the building. The concept of how to achieve this operational capability is the architecture. To gain the capability, we need the whole building. The basic delivery platform is akin to the structural steel. But without electrical equipment, plumbing, and the like the building is not useful. By the same token, operational capability is attained by the thoughtful integration of engagement systems, weapons, and munitions, with delivery platforms.

- Special permission should be required, from both the Defense Resources Board and the Defense Acquisition Board, to continue to study phenomenology when we should be undertaking programs to provide capability. Officials should be taken to task for wasting one of our most precious commodities--time.